

AIMS OF BIOLOGICAL RESEARCH IN SPACE EXPLORATION

One of the principal aims of space exploration is to secure detailed scientific knowledge of the other planets of the solar system, for comparison with the physics, chemistry, and natural history of the earth. This knowledge is expected to give us new insights into the origin and evolution of the physical universe, and of the chemical phenomena that constitute life. This extension of earth-bound science already suffices to justify the cost and effort that are entailed by space exploration; we have no doubt that the economic costs will also be amply repaid in the long run by technological applications of space science, in the same fashion as has always been true of pure science in other fields.

The capability of space vehicles has, until now, been the main limiting factor in the acquisition of new knowledge of the planets; however, the possibilities of telescopic studies from the earth, and from earth-based balloons have by no means been exhausted. Further, the development of telescopes mounted on satellite platforms in orbit above the earth's atmosphere should be very fruitful of new data on planetary chemistry. As we consider the prospects of direct communication with the planets by long range spacecraft, however, new issues present themselves, issues of cautionary wisdom as well as capability. These are of particular concern to biology, having to do with the unique capacity of living organisms, especially microorganisms, to proliferate rapidly and occupy new habitats. Our judgment as to the wisdom of direct communication must follow a careful assessment of the consequences of (1) the implications of terrestrial organisms on a planetary habitat, and (2) the converse, the "back contamination" of the earth by planetary organisms carried by a returning spacecraft.

Within the foreseeable future, the cost of sending an experimental device through space and receiving information from it will be many times that of using comparable analytical instruments in the laboratory. For many other reasons, the retrieval of samples of the planets would ultimately be the most informative means for the advancement of planetary science. This self-evident design has been and should continue to be foremost in the long range planning for the scientific utilization of spacecraft with the requisite capabilities. However, such missions also introduce the risk of back-contamination, a risk that cannot be decisively evaluated within the framework of our present knowledge of planetary biology. The same missions, as well as the one-way probes that will precede them, also entail the possibility of contaminating the targets; however, these missions can be programmed so as to minimize the carriage of "samples" of the earth, and to disinfect the spacecraft by methods of known efficacy for terrestrial organisms. Furthermore, as a matter of policy, acceptable risk figures for contaminating a planetary target must be substantially higher than for bringing trouble home.

From this standpoint, it may be fortunate that the vehicles for one-way missions will (as is obvious) become available first. We must make every effort to develop experiments that can be flown on such missions and give telemetered information on planetary life and life-habitats. Reassurances from such experiments as to the character of planetary life, and the indicated means to cope with its possible implantation on the earth, may make it possible to relax an implicit embargo on the re-admission of planetary spacecraft. Alternatively, they may move us to a more vehement policy of exclusion until we can be sure that the welfare of the human species is secure from one of the few kinds of threat fully within our capacity to avert.